IN THE CLAIMS:

1. **(Cancelled)**

2. **(Cancelled)**

3. **(Cancelled)**

4. **(Cancelled)**

5. **(Cancelled)**

6. **(Cancelled)**

7. **(Cancelled)**

8. **(Previously Presented)** A speed sensing system for measuring the speed of a target object, comprising:

a first differential speed sensor unit operatively disposed adjacent a surface of said target object, said first differential speed sensor unit configured to generate a first differential signal responsive to the passage of at least one random feature of said target object;

a second differential speed sensor unit operatively disposed adjacent a surface of said target object and displaced at a predetermined distance from said first differential speed sensor unit substantially in a direction of motion of the target object, said second differential speed sensor unit configured to generate a second differential signal responsive to the passage of said at least one random feature of said target object;

a signal processor configured to receive said first and second differential signals, said signal processor further configured to apply a cross correlation analysis to

determine a phase shift between said first and second differential signals, said phase shift inversely proportional to a speed of said target object; and

wherein said signal processor is configured utilize a Fast Fourier Transform-based algorithm to determine a cross correlation function between said generated differential signals, said cross correlation function defined by:

$$y(\tau) = \int x_1(t+\tau) \cdot x_2(t) dt$$

where

x_1 is said first generated differential signal;

x_2 is said second generated differential signal;

t is a signal time; and

τ is a time delay between said generated differential signals.

9. (Original) The speed sensing system of Claim 8 wherein said phase shift is associated with a maximum value for said cross correlation function; and wherein said signal processor is further configured to determine a maximum value for said cross correlation function;

wherein a speed v of said target object is determined from:

$$v = \frac{L}{\tau_0}$$

where L is said predetermined distance; and

τ_0 is a time delay corresponding to said determined maximum value for said cross correlation function.

10. (Cancelled)

11. (Cancelled)

12. (Cancelled)

13. (Previously Presented) A speed sensing system for measuring the speed of a target object, comprising:

a first differential speed sensor unit operatively disposed adjacent a surface of said target object, said first differential speed sensor unit configured to generate a first differential signal responsive to the passage of at least one random feature of said target object;

a second differential speed sensor unit operatively disposed adjacent a surface of said target object and displaced at a predetermined distance from said first differential speed sensor unit substantially in a direction of motion of the target object, said second differential speed sensor unit configured to generate a second differential signal responsive to the passage of said at least one random feature of said target object;

a signal processor configured to receive said first and second differential signals, said signal processor further configured to apply a cross correlation analysis to determine a phase shift between said first and second differential signals, said phase shift inversely proportional to a speed of said target object;

each of said first and second differential speed sensing units having an identical sampling rate; and

wherein said identical sampling rate is substantially greater than a signal variation rate for said first and second differential speed sensing units.

14. (Cancelled)

15. (Cancelled)

16. (Cancelled)

17. (Cancelled)

18. (Cancelled)

19. (Cancelled)

20. (Previously Presented) A speed sensing system for measuring the speed of a target object, comprising:

a first differential speed sensor unit operatively disposed adjacent a surface of said target object, said first differential speed sensor unit configured to generate a first differential signal responsive to the passage of at least one random feature of said target object;

a second differential speed sensor unit operatively disposed adjacent a surface of said target object and displaced at a predetermined distance from said first differential speed sensor unit substantially in a direction of motion of the target object, said second differential speed sensor unit configured to generate a second differential signal responsive to the passage of said at least one random feature of said target object;

a signal processor configured to receive said first and second differential signals, said signal processor further configured to apply a cross correlation analysis to determine a phase shift between said first and second differential signals, said phase shift inversely proportional to a speed of said target object;

wherein said first differential speed sensor unit includes first and second speed sensors spaced at least perpendicular to a direction of motion of the target object, each

of said first and second speed sensors configured to generate a signal responsive to the passage of at least one feature of said target;

wherein said second differential speed sensor unit includes third and fourth speed sensors spaced at least perpendicular to a direction of motion of the target object, each of said third and fourth speed sensor units configured to generate a signal responsive to the passage of at least one feature of said target object;

wherein said first and third speed sensors are disposed along a common line parallel to the direction of motion of the target object;

wherein said second and fourth speed sensors are disposed on a second common line parallel to the motion of the target object;

wherein said first differential signal is representative of a difference between said signals generated by said first and second speed sensors; and

wherein said second differential signal is representative of a difference between said signals generated by said third and fourth speed sensors.

21. (Previously Presented) The speed sensing system of Claim 20 wherein said signal processor is configured to cancel signal components common to said signals generated by said first, second, third, and fourth speed sensors.

22. (Previously Presented) The speed sensing system of Claim 20 wherein said first and third speed sensors are configured to observe surface features of said target object; and

wherein said second and fourth speed sensors are configured to observe subsurface features of said target object.

23. (Previously Presented) The speed sensing system of Claim 20 wherein said first, second, third, and fourth speed sensors define a parallelogram having two sides parallel to the direction of motion of said target object.

24. (Previously Presented) The speed sensing system of Claim 23 wherein said first, second, third, and fourth speed sensors define a rectangle having two sides perpendicular to the direction of motion of said target object.